Experiment 2 Preliminary Work
Miscellaneous Opamp Circuits

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Contents

1 Step 1

In this step the independent current source circuit is investigated. The reference circuit is given in Figure 1.

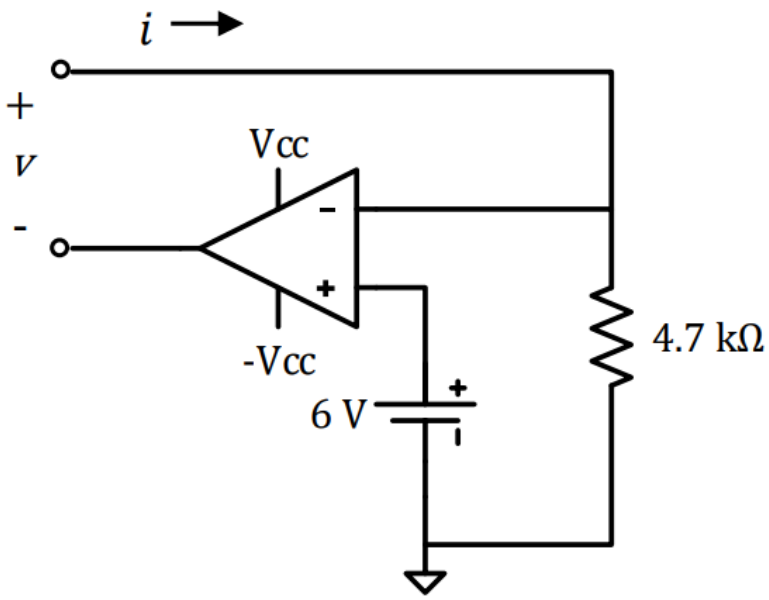

Figure 1: Circuit schematic for the step 1

1.1 a)

To obtain the i-v charactheristics, the analysis is made and given in Figure 2. The analysis also includes the part b .

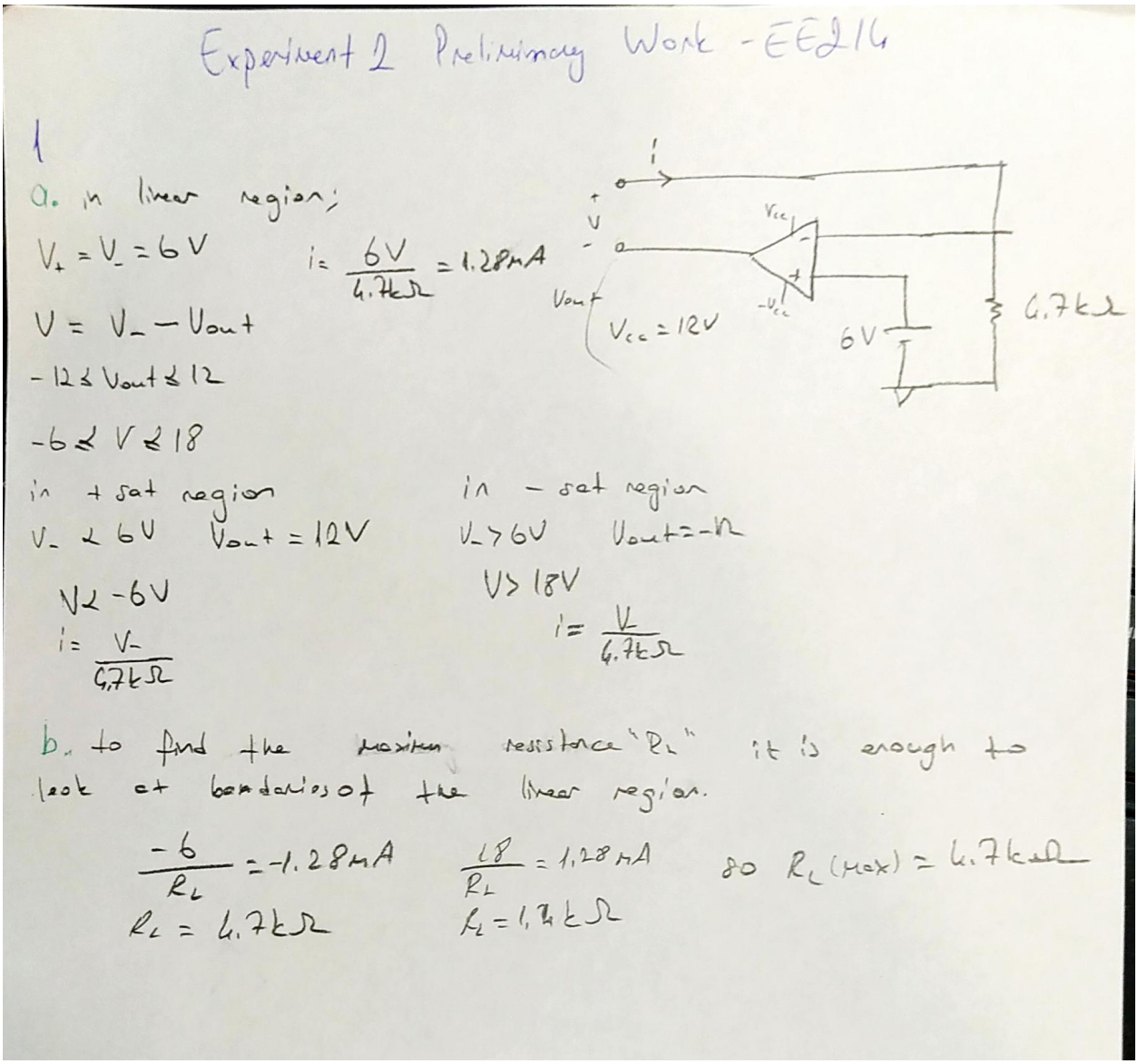

Figure 2: calculation of i-v

1.2 c)

The simulation of the circuit given in Figure 1 is constructed in LTSpice environment. The schematic is given in Figure 3 .

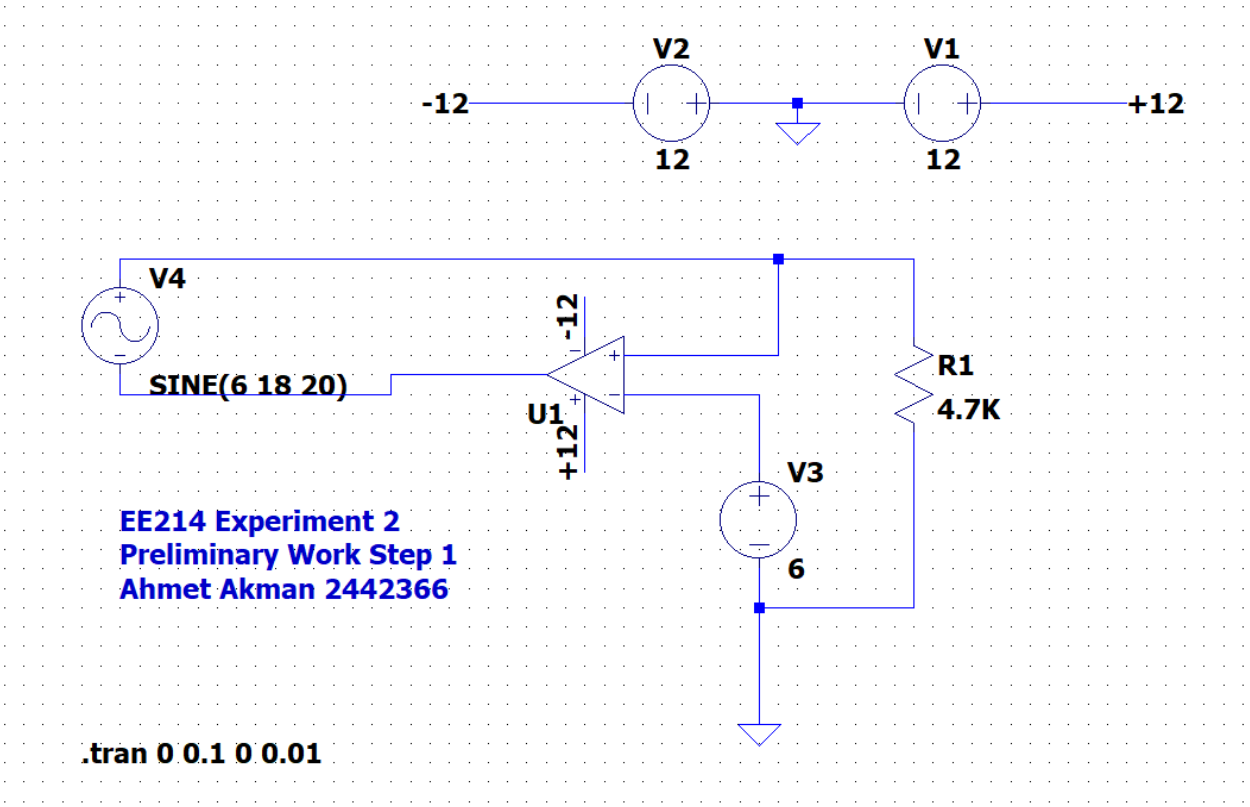

Figure 3: Circuit simulation schematic for the step 1

As a result, the plot given in Figure 4 is obtained.

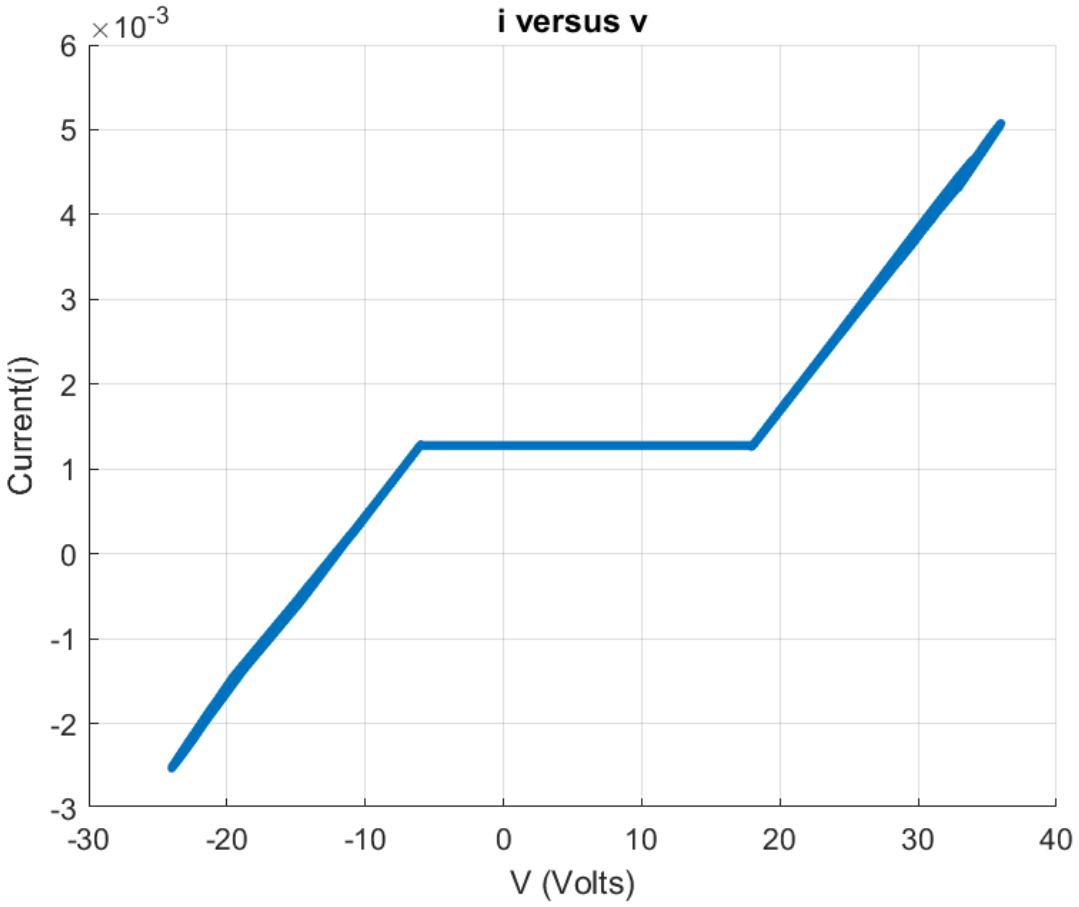

Figure 4: i versus v plot

So, it is again observed that in the linear region the circuit behaves like an independent current source even though it can take multiple values and seems unstable.

2 Step 2

The schematic is given in Figure 5 is taken as the reference .

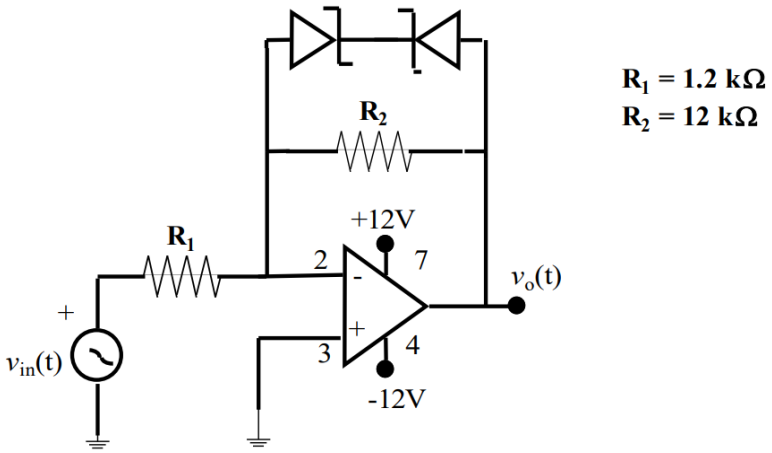

Figure 5: Circuit schematic for the step 2

The simulation of the circuit given in Figure 6 is constructed in LTSpice environment.

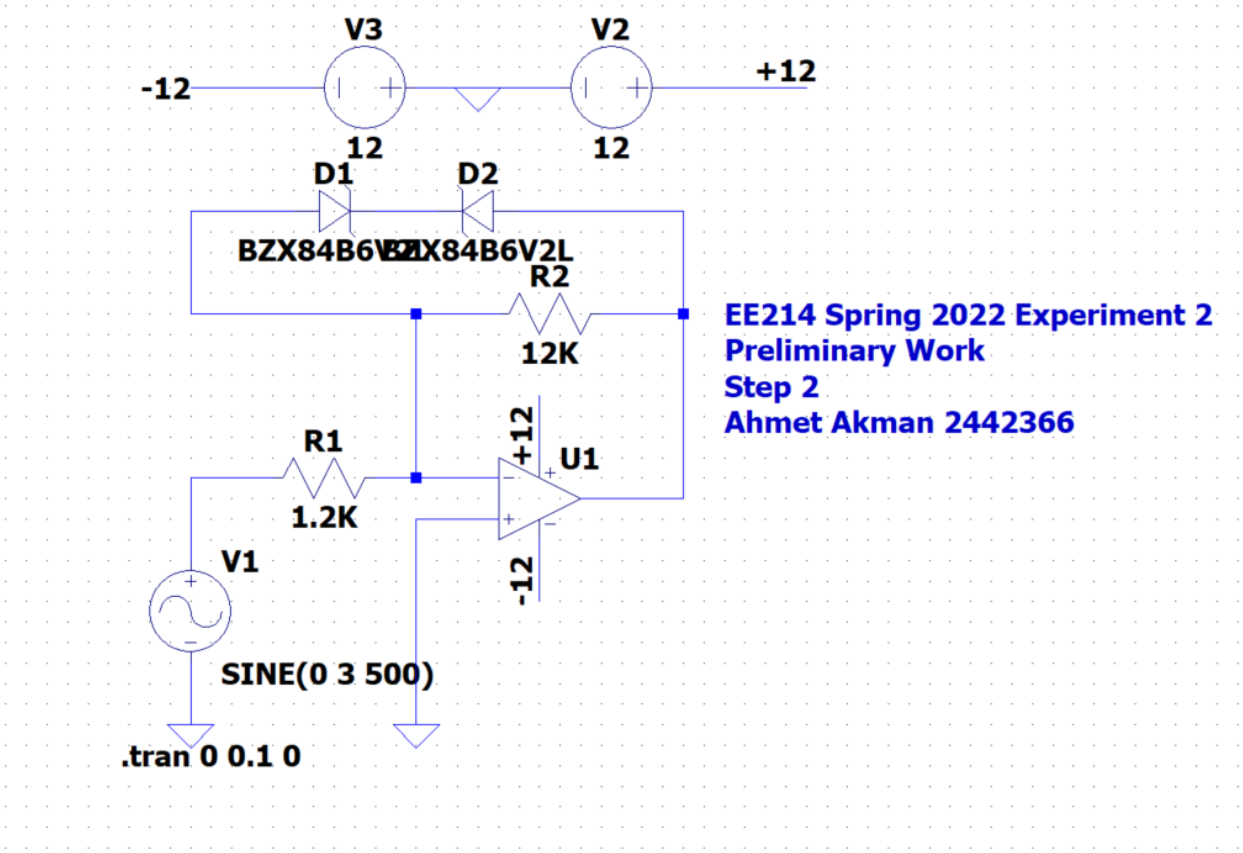

Figure 6: Circuit simulation schematic for the step 2

As a result, the plot given in Figure 7 is obtained.

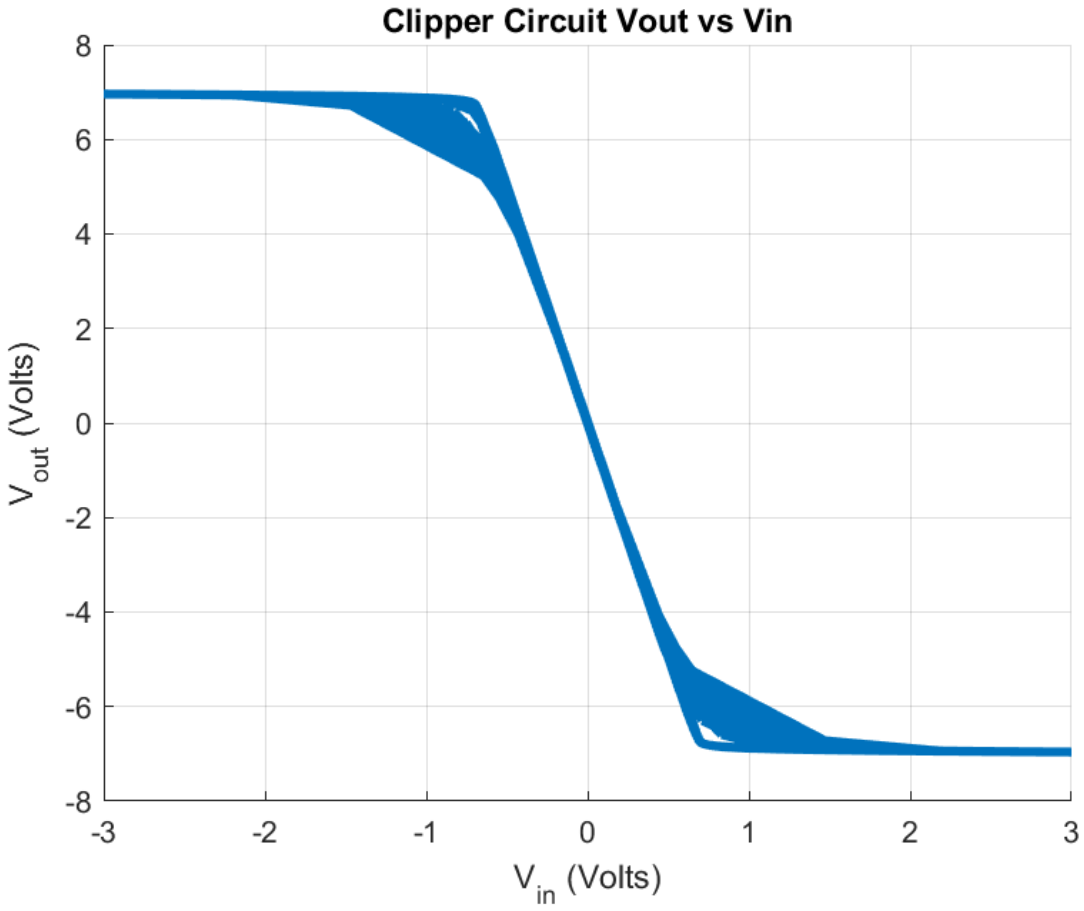

Figure 7: V_{in} and V_o versus time

3 Step 3

In this step the circuit schematic given in Figure 8 is taken as the reference.

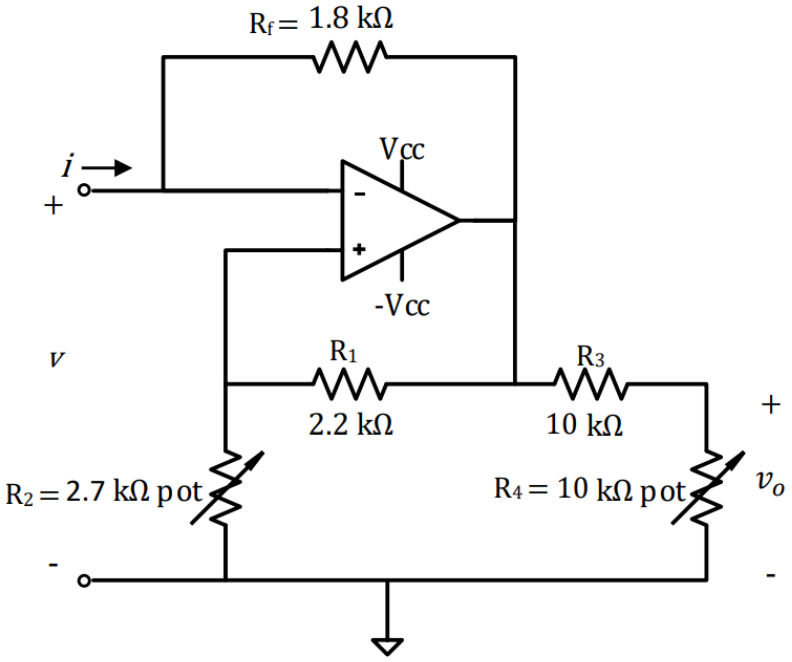

Figure 8: Circuit schematic for the step 3

3.1 a)

The calculations and skteches are made on paper as given in Figure 9 for part a.

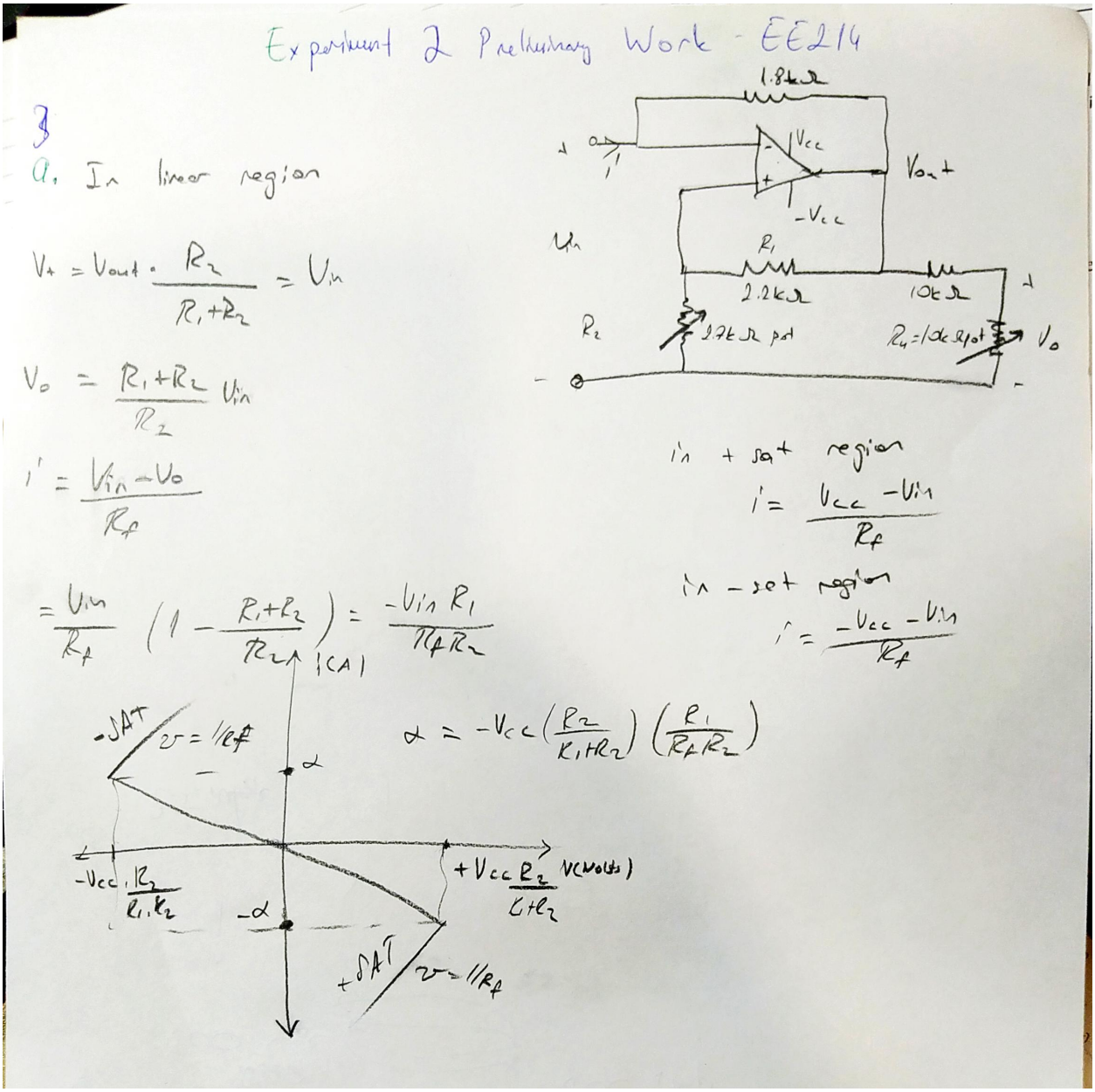

Figure 9: calculation and i-v sketch

3.2 b)

To find the factors that may effect the frequency of the resulting square wave, in addition to the analysis made in the previous step V_c is added. The graph of the V_c shows that the capacitor is constantly charges and discharges in time. Also, the op-amp is changed between the + and - saturation regions. So the period is obtained as follows:

$$T = -2R_fCln(\frac{R_1}{R_1+R_2})$$

Since the frequency is the inverse of the period, it can be said that the frequency is dependent on the quantities appearing in the above expression which are R_f, C, R_1 and R_2. Since the relation between V_{out} and V_o is simply dependent on voltage division. It is dependent on the V_{cc} , R_3 and R_4.

3.3 c)

By looking at the equations provided in part b and the resistance values given, in order to set the frequency 500Hz, R2 should be adjusted to approximately 1.63KΩ. In order to make V_o equal to 2 Volts, (assuming the $Vccissetto12volts$) the pot R_4 should be set to 2KΩ.

3.4 d)

The simulation of the circuit given in Figure 8 is constructed in LTSpice environment. The schematic is given in Figure 10 .

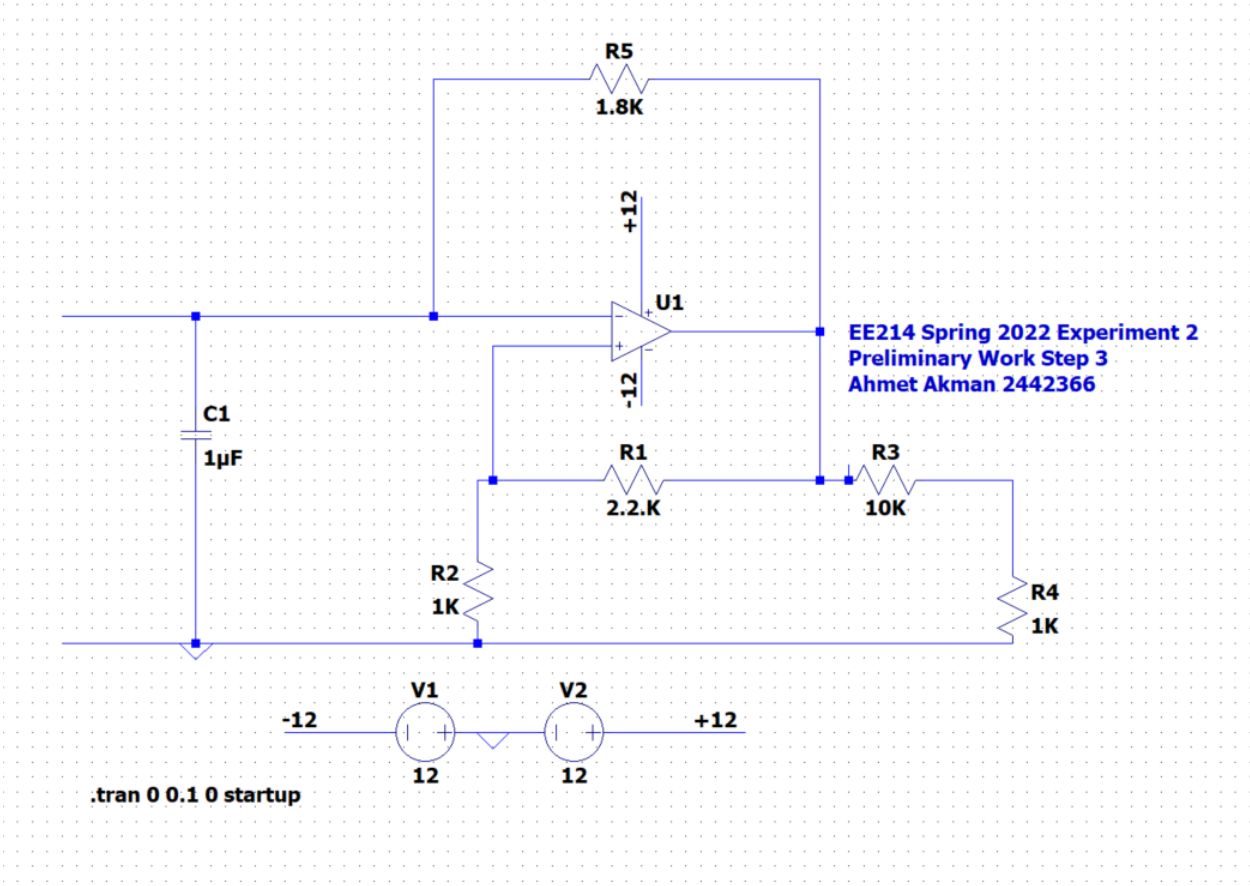

Figure 10: Circuit simulation schematic for the step 3

As a result, the plot given in Figure 11 is obtained.

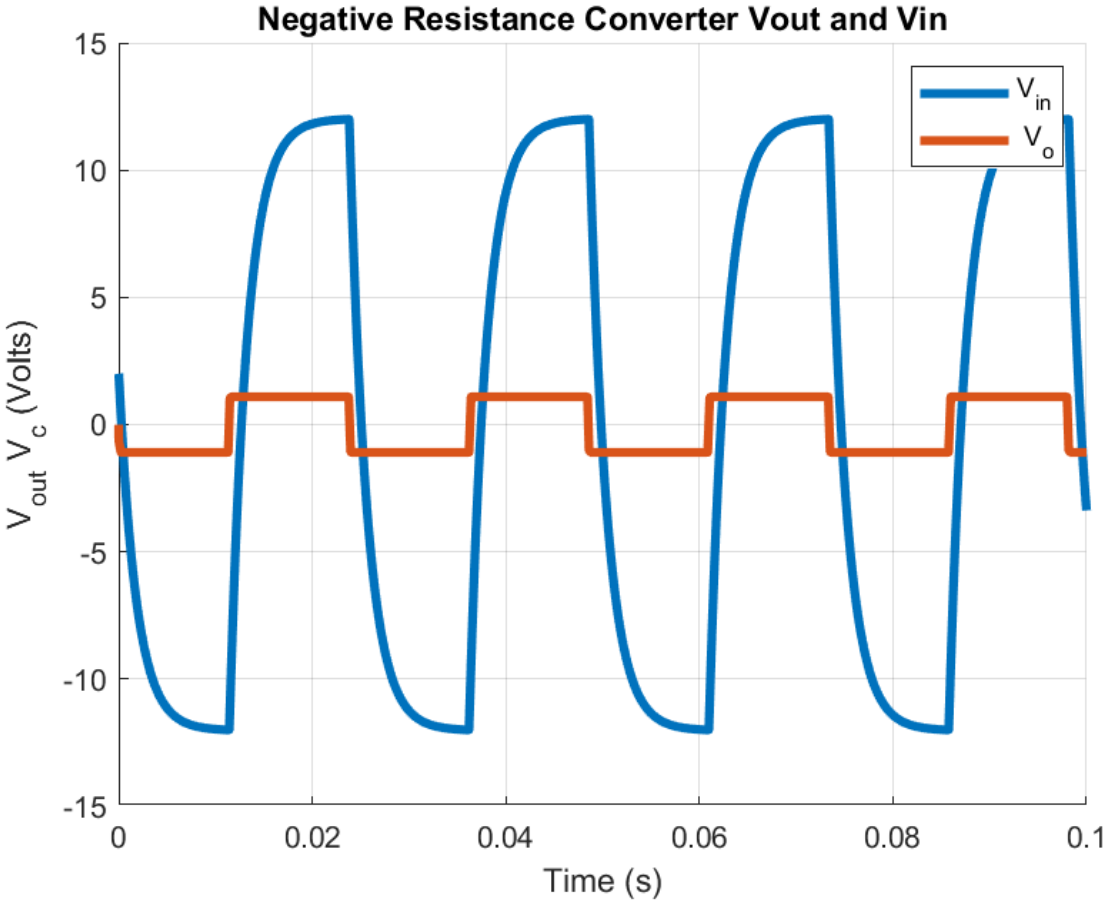

Figure 11: V_{in} and V_o versus time

4 Conclusion

In this document, three miscellaneous opamp circuits are analyzed, therefore driving point charactheristics are obtained. The simulations are made and necessary plots are obtained. So the requirements of the preliminary work is satisfied.

Appendix A

The results of the simulations are fetched from LTSpice and plotted in MATLAB in order to make the plots more readable and convenient.